> "…what we have traditionally called our universe may be just one 'island' in an infinite archipelago." (p. 147)

The notion of infinite possibilities can lead one to the conclusion that whatever 'is', must exist some place-time. Infinite combinations of elements of reality MUST-some place-time arrange as they do here-now. The usual argument made is that given the numbers of things that had to fit properly for humans to develop on earth, there must have been a plan. In my view, this is *The Spirit in the Gene* at work [1]; humans feel special and create the meaning of life to suit that need. Obviously, given infinite timespace and constant change, a planet ripe for human life is a necessary eventuality. We have difficulty with the concept of infinity; and we do not like thinking of ourselves as an accident!

It seems to me that most humans have difficulty thinking and behaving with long term horizons in mind. We may focus on, for example, our next bonus, paycheck, job, meal, sexual encounter, or crime. The tougher our personal circumstance is, the shorter term is our required focus. Survival is number one. Recall the native American notion of Seven Generations. A sustainable human future requires that sort of thinking in my opinion, and I think Rees fully agrees.

All in all, Rees has done a magnificent job of framing the risks of the 21st century. The book is quite accessible, and I would like to see it required reading for all capable of high school level material. The fewer of us flying blind into the future the better.

References

[1] R. Morrison, The Spirit in the Gene: Humanity's Proud Illusion and the Laws of Nature, Cornell University Press, 1999.

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Douglas Mulhall, Our Molecular Future: How Nanotechnology, Robotics, Genetics and Artificial Intelligence will Transform our World (2002, Prometheus Books, New York) 375 pages, £28.00.

Most scientists dislike speculating about the future in public and feel most comfortable simply evaluating existing evidence. Their inherent caution limits their usefulness when it

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comes to planning our long-term future. And as the pace of the scientific enterprise quickens, often under the cloak of commercial secrecy, we find ourselves unexpectedly confronted by ethical dilemmas that we are ill-equipped to deal with. Reproductive cloning technologies are a case in point. When Dolly the sheep met the press for the first time she triggered a moratorium and a flurry of panicky piecemeal legislation, designed to give philosophers and legislatures time to advance into the ethical void which science had exposed.

What we need is a mechanism for stimulating pre-emptive ethical debate about future scientific breakthroughs. Science needs speculators who can extrapolate current developments to the boundaries of credibility and beyond, even into the realms of science fiction. Enter Douglas Mulhall, who has amassed every shred of existing evidence to paint a picture of what our molecular future might be like.

Our Molecular Future embraces nanotechnology, robotics, genetics and artificial intelligence, but it is the first of these that will probably intrigue most readers, partly because many of us are only vaguely aware of what nanotechnology entails. It is the development of molecular systems that can build minute devices, including copies of themselves, with atomic precision. Some, like graphite nanotubules that can act as sub-microscopic bearings, have already been made. Because nanodevices would be invisible without electron and scanning tunnelling microscopes, and would carry out tasks relentlessly while they self-replicate unchecked, it is hardly surprising that they have already aroused a good deal of public concern. One science speculator, Prince Charles, worries that they might reduce the planet to 'grey goo'.

Mulhall writes about nanotechnology with bouncy enthusiasm. He describes how, combined with robotics, virtual reality and molecular genetics it might allow us to live a sybaritic life style where we hardly needed to move from our homes to live and work, eating food made by molecular assemblers rather than grown in fields. Even old men's fantasies are catered for, thanks to molecular advances in health care: "Marriages between septuagenarians and twenty year-olds are common, as genetic therapy reduces the impacts of aging. Experience merges with youthful exuberance to constitute the most valuable and sexy commodity", he assures us, in what may become future nanotechnologists' standard chat-up line.

It is a life style prediction that will be heaven for disciples of scientism and hell for those who long for a return to a more holistic, organic, spiritual association with our environment. Still, if the temptations of unbridled materialism do not seduce you, may be fear will do the trick. Mulhall has spotted a hole in the environmentalist agenda, created by asteroids. He fears that sooner or latter one of these wayward heavenly bodies will strike us and devastate the planet. This nightmare is more likely to haunt the rich and comfortable than the subsistence farmer or shanty town dweller who live in environments that deteriorate daily, but Mulhall argues that only commitment to nanotechnology can save us all. His strategy is to create a space shield, in the form of clouds of nanosatellites that detect an incoming rogue object and send out task forces of nanobot asteroid munchers that land on its surface, replicating at a furious pace while they break it down molecule by molecule.

Here lies the first of several problems that I have with this book. Mulhall does not explain adequately *how* inventions like nanosensors would detect earthquakes, *how* food

molecular assemblers would make food or *how* nanosatellites would function. Without at least some explanation, they are as plausible as the Tooth Fairy. The second problem is that the torrent of ideas is overwhelming. Copious end notes testify to Mulhall's mountain of research and he seems determined to leave nothing out. The third problem is that I can remember reading about some of the 'cutting-edge' technologies he mentions in comics back in the 1960s. For example, he is clearly wedded to the idea of robotic personal aerocars. Given the present day limitations of air traffic control and traffic congestion I can more easily accept his concept of sub-microscopic nanobots, that do everything from cleaning the toilet to repairing our DNA, than I can believe in a society where personal transport depends on the population becoming airborne.

The best part of the book comes in the last 50 pages, where Mulhall discusses issues concerning public trust in current science that will determine how the future unfolds. Along the way he raises interesting questions about technology abuse, scientists' misunderstanding of public perceptions, technology-based terrorism, the collapse of the patenting system in the face of a tidal wave of new technology, and the future of democracy in a world where new technologies liberate the individual. Speculation on future technologies is entertaining, but these issues are timeless.

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David Z. Rich, editor. Order and Disorder (2001, Greenwood, New York) pp. 272, $69.95

Felix Geyer and Johannes van der Zouwen, editors. Sociocybernetics: Complexity, Autopoiesis and Observation of Social Systems (2001, Greenwood, New York) pp. 26, $62.50

The first of these books is interesting but irritating. If it had been published some ten years ago it would have been an original, if idiosyncratic, assertion of the relevance of complexity theory to contemporary thinking about life, the universe, and everything. It still does include a thorough review of many central ideas, although it is not up with the latest non-scientistic literature on complexity—for example Cilliers' seminal Postmodernism and Complexity Theory (1998). Even ten years ago it would have been irritating because it is one of those compendium books into which a well-read author throws